

about 60° azimuth, and consisting of a diffused white light resting upon a dark bank of clouds, was observed in the north at 9.55 p. m. At 10.15 p. m. the display became more active and several broad streamers shot upward toward the zenith, and the color at the base changed to an orange shade. "Merry dancers" were observed at 10.40 p. m.; the aurora began to fade at 11.15 p. m.; and it disappeared at midnight.

Sault de Ste. Marie, Mich., 8th: an aurora consisting of a bright yellow arch, extending from w. to ne. and resting on a dark segment, was observed 8.15 p. m. The arch extended to about 20° altitude, with bright streamers; it attained its maximum brilliancy about 10.35 p. m.; and disappeared about 11.05 p. m.

THUNDER-STORMS.

Thunder-storms were reported as follows: east of the Rocky Mountains thunder-storms were reported in the greatest number of states, 30, on the 18th; in 20 to 25 on the 15th, 16th, 17th, 21st, and 22d; in 15 to 19 on the 9th, 10th, 14th, 19th, 20th, and 23d; in 10 to 14 on the 1st, 8th, 11th, 12th, 13th,

and 30th; in 5 to 9 on the 2d, 7th, 28th, and 29th; and in 1 to 4 on the 3d to 6th and 25th to 27th. There was no date for which thunder-storms were not reported east of the Rocky Mountains.

East of the Rocky Mountains thunder-storms were reported on the greatest number of dates, 23, in Mich.; on 21 in Tex.; on 15 to 20 in Ark., Fla., Ill., Iowa, Kans., Mo., and N. C.; on 10 to 14 in Ind., Minn., Miss., Nebr., N. J., Ohio, Pa., S. Dak., and Tenn.; on 5 to 9 in Ala., Conn., Ga., Ky., La., Md., Mass., N. Y., S. C., Va., Okla. T., and Wis.; and on 1 to 4 in Del., D. C., Me., Mont., N. H., N. Dak., R. I., Vt., and W. Va. West of the Rocky Mountains thunder-storms were reported in Ariz. on the 16th and 27th; in Cal. on the 6th, 7th, 13th, and 24th; in Colo. on the 14th, 18th to 20th, and 26th to 28th; in Idaho on the 16th; in Nev. on the 11th, 16th, and 18th; in N. Mex. on the 6th, 27th, 29th, and 30th; in Oregon on the 7th, 15th, 16th, and 23d; in Utah on the 15th to 20th, and 28th; in Wyo. on the 12th and 15th. In Wash. no thunder-storms were reported.

VERIFICATIONS.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

FORECASTS FOR 24 HOURS IN ADVANCE.

The forecasts for districts east of the Rocky Mountains for April, 1891, were made by Captain James Allen, Signal Corps, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant John P. Finley, 19th Infantry.

Percentages of forecasts verified, April, 1891.

States.		States.	
Maine.....	78.3	Kentucky.....	79.5
New Hampshire.....	75.1	Ohio.....	82.3
Vermont.....	78.9	West Virginia.....	83.2
Massachusetts.....	84.5	Indiana.....	80.5
Rhode Island.....	80.4	Illinois.....	82.3
Connecticut.....	78.7	Lower Michigan.....	78.7
Eastern New York.....	91.5	Upper Michigan.....	82.5
Western New York.....	85.1	Wisconsin.....	88.3
Eastern Pennsylvania.....	86.7	Minnesota.....	84.1
Western Pennsylvania.....	86.3	Iowa.....	82.5
New Jersey.....	88.1	Kansas.....	83.8
Delaware.....	83.7	Nebraska.....	87.2
Maryland.....	86.1	Missouri.....	81.9
District of Columbia.....	86.5	Colorado.....	81.5
Virginia.....	86.3	North Dakota.....	79.0
North Carolina.....	79.0	South Dakota.....	79.3
South Carolina.....	85.0	Southern California*.....	92.7
Georgia.....	83.8	Northern California*.....	86.7
Eastern Florida.....	82.5	Oregon*.....	78.9
Western Florida.....	86.9	Washington*.....	81.5
Alabama.....	85.7		
Mississippi.....	82.5	By elements: Weather.....	88.0
Louisiana.....	81.0	Temperature†.....	74.9
Texas.....	81.0	Monthly percentage of weather and	
Arkansas.....	78.8	temperature combined‡.....	82.8
Tennessee.....	76.5		

* In determining the monthly percentage of weather and temperature combined, the Pacific coast states are not included. † The forecasts of temperature in districts east of the Rocky Mountains for April, 1891, were made with reference to the maximum temperature alone; that is, a prediction of warmer or cooler indicated that the maximum temperature of the day designated would be higher or lower than the maximum of the previous day. ‡ The monthly percentage of weather and temperature combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10.

FORECASTS FOR 48 HOURS IN ADVANCE.

Appreciating the great importance that long time predictions possess for the general public the Chief Signal Officer has authorized forecasts for 48 and 72 hours, covering the 2d

and 3d days in advance. These are optional with the forecast official, and are only made when clearly in the public interest, and cover, in all cases, considerable areas of country, and are not confined to localities.

Percentages of verifications made for second day in advance. Number of predictions made: weather, 214; temperature, 115. Percentages of verifications: weather, 93.8; temperature, 87; weather and temperature combined, 92.0.

WIND SIGNALS FOR APRIL, 1891.

Statement showing percentages of justifications of wind signals for the month of April, 1891.

Wind signals—(Ordered by Captain James Allen).—Total number of signals ordered, 91; justified as to velocity, wholly, 53, partly, 7; justified as to direction, 89. Of the signals ordered, 78 were cautionary, of which 44 were wholly and 4 partly justified; and 13 were storm signals, of which 9 were wholly and 3 partly justified. 28 signals were ordered for easterly winds, of which 26 were justified, and 63 were ordered for westerly winds, all of which were justified. Percentage of justifications, 67.0.

TEMPERATURE-FALL WARNINGS.

[Ordered by Assistant Professor T. Russell.]

Number of warnings issued, 16; justified 6. Percentage of justifications, 37.5. No cold-wave signals were ordered during the month.

Percentages of verifications of weather and temperature signals reported by directors of the various State Weather Services for April, 1891.

States.	Weather.	Temperature.	States.	Weather.	Temperature.
Illinois.....	87	71	Nebraska.....	84	94
Indiana.....	86	91	New Jersey.....	87	89
Iowa.....	88	93	New York.....	87	87
Michigan.....	87	91	North and South Dakota.....	84	92
Minnesota.....	82	86	Ohio.....	87	92
Missouri.....	89	85	Pennsylvania.....	84	88

STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts and summaries are republished from reports for April, 1891, of the directors of the various state weather services: